

A Verbal Behavior Analysis of Auditory Hallucinations

Caleb E. S. Burns, Elaine M. Heiby, and Roland G. Tharp
University of Hawaii

A review of recent research on the non-medical control of auditory hallucinations is presented. It is suggested that the decreases in hallucinatory behavior obtained in studies using aversive contingencies may be attributable to the disruption of the chains of behavior involved. The results of several additional studies are interpreted as indicating that methods of stimulus control and the use of incompatible behaviors may be effective in reducing the rate of auditory hallucinations. Research relating auditory hallucinations to subvocalizations is presented in support of the view that hallucinatory phenomena are sometimes related to the subject's own vocal productions. Skinner's views (1934, 1936, 1953, 1957, 1980) are then presented as possible explanations of some hallucinatory behavior. It is suggested that some auditory hallucinations consist of the mishearing of environmental and physiological stimuli as voices in a fashion similar to that which Skinner observed in his work with the verbal summator. The maintenance of long chains of such responses may be largely attributable to self-intraverbal influences (such as are present during automatic writing). With some auditory hallucinations, this progression involves first mishearing ambiguous stimuli as voices and then attributing the voices to some cause (e.g., insanity, the television, radio, or God). Later, the frequent and ongoing chains of such behavior may contaminate other verbal responses. Such verbal behavior may be parasitic on "normal verbal behavior" (and hence, not directly dependent on consequences for maintenance), may be cued by various stimuli (including respiration), and may interfere with other covert and overt behavior. Several studies to investigate this view are presented. It is hoped that such research will lead to a better understanding of the major issues involved in the etiology and treatment of auditory hallucinations in particular and perhaps of psychosis in general.

As Turner, Hersen, and Bellack (1977) noted: "Despite the general ability of antipsychotic medications to control hallucinatory behavior, a small percentage of psychotic patients remain refractory to drugs as well as other methods of treatment" (p. 249). (Recent reviews of this problem include Gomes-Schwartz, 1979; Heppner, 1978; Paul, 1969.) Several aspects of hallucinatory behavior, including its privacy, make this disorder both difficult and important to study.

Skinner (1957) noted the difficulty of examining private events within the rubric of a natural science, pointing out that "the investigator cannot readily point to the stimuli to which he must appeal in predicting and controlling behavior" (p. 130). It may well be the private nature of auditory hallucinations that makes it still true today that, as Moser (1974) noted, "Hallucinatory behavior is a response class that has received little attention from behaviorists" (p. 290). Nevertheless, the hallucination phenomenon is an important area of research for behavior analysts because, in addition to providing an opportunity to study private events, it can interfere with other appropriate behavior and pose a debilitating problem for the sufferer.

The authors would like to acknowledge the valuable criticisms and advice of three people: Michael Wylie, University of Hawaii; and Roderick Calkins and Mark Troy, Kamehameha Educational Research Institute, Kamehameha Schools, Honolulu, Hawaii. Also, the encouragement and input from Frank J. McGuigan and Mark Sundberg were most helpful. In addition, we were fortunate to have had Margaret Vaughan as an advisor/helper. Finally, Reviewers A through D, whoever you are, thanks for your criticisms and excellent ideas (most of which we shamelessly incorporated). Reprints may be obtained from Elaine Heiby, Department of Psychology, University of Hawaii, Honolulu, HI 96822.

This paper will first present different approaches to the study and control of auditory hallucinations, including punishment, negative reinforcement, stimulus control, and the use of competing behaviors. (One study involving visual hallucinations is included as germane to

the discussion.) One analysis of subvocalizations in the "hearing of voices" will then be presented. Next, this paper will present the view that auditory hallucinations, for the most part, consist of mishearing nonverbal external and internal stimuli as voices and that these stimuli are heard as smaller or larger strings of verbal behavior. Finally, various research topics will be proposed to clarify aspects of auditory hallucinations.

PROCEDURES AFFECTING HALLUCINATIONS

Punishment and Negative Reinforcement

Several studies have suggested that auditory hallucinations can be affected by the use of contingent aversive stimuli. Case studies have shown that contingent self-administered shock (Bucher and Fabricatore, 1970), covert imagery (Moser, 1974), and therapist-controlled time-out (Haynes and Geddy, 1973), result in a reduction of reported hallucinations. Alford and Turner (1976), using a single-subject design, have shown that the effect of contingent conversation upon the frequency of hallucinations reverses following withdrawal but that the effect of contingent shock persists through several subsequent conditions.

Similarly, Turner, Hersen, and Bellack (1977) compared the effects of experimenter-administered shock and bell-ringing and found the shock to be more effective in reducing hallucinations. It appears, therefore, that noxious consequences constitute an effective treatment in reducing hallucinations.

Weingaertner (1971) conducted a group study to determine whether the aversive component of self-consequence is critical in controlling auditory hallucinations. He found that a self-shock group, a placebo group (in which the shocker delivered no shock to the wearer) and a no treatment control group all improved on various indices, including that of auditory hallucinations. While the greatest reported decline in hallucinations came with the self-shock group, the difference between this group and the other two groups were not significant. The results

also showed that subjects in the self-shock group actually activated their devices more than did the subjects in the placebo group.

These results can be interpreted in a variety of ways. Although aversive consequences appear to reduce the frequency of auditory hallucinations, another component of the procedure may be responsible. Would a replication of the Turner et al. (1977) study but using electric and auditory stimuli of different intensities show similar effects? That is, the reduction may be attributable to disruption of the hallucinatory behavior rather than aversive consequences per se. If so, self-initiated nonaversive auditory stimuli should function as effectively as noxious stimuli in reducing auditory hallucinations.

In addition, the comparison of self- or experimenter-administered shocks may help ascertain the role of self-consequence in the reduction of reported hallucinations. Moreover, there is a need for more multiple baseline studies because the effect of treatment does not always reverse (Bucher and Fabricatore, 1970).

Stimulus Control and Competing Behavior

One of the ways in which stimulus control procedures differ from aversive procedures is that the antecedent variables are manipulated rather than the consequences. Studies in the area of stimulus control emphasizing competing behavior involve the introduction of responses that are incompatible with auditory hallucinations and that are introduced primarily through instructional procedures.

Fisher and Winkler (1975) reported a case study of an 18-year-old undergraduate who was taught to control the onset and offset of her visual hallucinations through a self-control procedure. The client practiced imagining scenes similar to her visual hallucinations. When she had imagined such a scene, she signalled the therapist by raising her finger. The client then practiced dismissing the image as quickly as possible. The authors noted that the self-control approach used

in this study might be more effective if employed early in the development of intrusive experiences before the client has attributed the experiences to being insane or before the client has developed new behavior to cope with or 'explain' the intrusive experiences (p. 915).

Another study examining stimulus control was conducted by Lindsley (1963), who suggested that hallucinatory behavior may not be controlled by differential reinforcement. Subjects were instructed in the operation of a plunger mechanism by which they could earn various reinforcers. Attempting to determine the evocative stimuli for the observed hallucinatory behavior, Lindsley presented different types of auditory stimuli through a hidden speaker to known hallucinators while they were working for candy. Lindsley noted that even in the instances in which the hallucinators did not verbalize to the stimulus, the rate of plunger pressing declined, an indication that the patient was emitting a response incompatible with (or disruptive to) the desired plunger pressing response. Lindsley also noted that a brief stimulus presentation was usually sufficient to initiate an extended series of vocalizations, some continuing for as long as 30 minutes after terminating the stimulus. Further, while some patients vocalized only to auditory stimuli similar to their own vocalizations, the more severely hallucinating patients vocalized to auditory stimuli widely different from their own vocalizations. Another interesting result was that contrary to prediction, when presentation of candy was made contingent upon vocal hallucinations, such hallucinations did not increase, but actually decreased in rate. Lindsley concluded that "The results of this experiment suggest that vocal psychotic symptoms are under some form of internal control that resists direct differential positive reinforcement" (p. 206).

Several case studies report a reduction in hallucinations following training in competing responses, such as assertion (Nydegger, 1972) and systematic desensitization (Slade, 1972). Also, Erickson and Gustafson (1968) described several

simple competing behaviors that helped patients to reduce their auditory hallucinations. Based upon the research by Gould (1950), they concluded that "the patient's own vocal apparatus is involved in producing his voices. We have applied that finding in our own work with hallucinating patients by getting them to hum, gargle, or in some other way use their vocal cords; those simple actions can be used to show the patient how to stop the voices" (p. 327). Erickson and Gustafson noted, however, that it is not always simple to persuade patients to bring the voices under control, although "The physical technique of using the vocal cords for other purposes is easily demonstrated and invariably successful" (p. 45).

Falloon and Talbot (1981) explored the coping strategies of 40 chronic schizophrenic out-patients with persistent auditory hallucinations, and they found a similarity of coping skills across individuals (these included increased interpersonal contact, relaxation or sleep, and reduced attention to the hallucinations). Several differences, however, did occur between those who coped well and those who coped poorly. Patients who appeared to be coping well with the voices often used fewer coping skills than the more poorly coping patients. Further, "these patients appeared to have a clear understanding of the discriminative stimuli associated with the onset of their hallucinations, and frequently chose to avoid such situations so as to prevent the onset of the 'voice'" (p. 338).

Hence, this descriptive study seems to support the effectiveness of teaching competing behavior as well as stimulus control. However, the lack of controls and the absence of a clear specification of competing responses makes firm conclusions based on this study difficult. In fact, these problems are apparent in all of the above studies (e.g., lack of controls, lack of independent verification of the hallucinatory behavior, etc.). However, results do seem to support the effectiveness of both stimulus control methods and procedures involving competing behavior to reduce auditory hallucinations.

THE ROLE OF SUBVOCALIZATION

Gould (1950) found that several of the patients he interviewed were aware that they themselves were generating the voices they were listening to—that is, they were aware that the “voices” were coming from their own vocal apparatus. One respondent said she felt the vibrations from her larynx almost as she heard them, while another respondent pointed to her larynx as the source of the voices. In addition to similar kinds of evidence, Gould turned to EMG and other techniques to observe the activity of the larynx, noting that “Preliminary research indicates facile participation of the hallucinating patient’s own speech mechanisms during imagined speaking and hearing” (p. 118).

McGuigan (1966), studying auditory hallucinations as covert language behavior, also obtained evidence of EMG activity during hallucinations with one patient. Results of electrodes positioned on the subject’s body showed that the muscular activity was localized to the speech organs and that it often preceded reported instances of auditory hallucinations. Furthermore, soft whisperings from the subject were also picked up from the subject’s throat during the study, and in one phase of the study, the subject was asked to repeat orally when the voices spoke and to repeat what they were saying. In eight out of the ten trials, whisperings could be heard on the tapes about one second before the patient reported the onset of the hallucinations, and in two of the ten occasions, recordings of the whisperings made before the patient reported hearing hallucinations agreed with what the patient reported the voices as saying.

McGuigan noted that “It may well be that covert oral language behavior . . . is a necessary condition for the report of an hallucination, that the ‘hallucinatory experience’ is initiated when a person ‘talks to himself’ ” (p. 80).

His findings have been replicated by Inouye and Shimizu (1970) who studied six patients diagnosed as chronic paranoid schizophrenics and three diagnosed as undifferentiated schizophrenics. Re-

sults indicated that 47.6% of the reported auditory hallucinations were accompanied by activity of the speech musculature. Furthermore, reported instances of loud or soft auditory hallucinations were significantly correlated with high or low EMG potentials.

Perhaps the most interesting result of these studies is not the occurrence of subvocal speech, but the finding that the subjects are often not aware that they are engaging in such behavior. Subvocal speech is, after all, a common and perhaps universal phenomenon (Garrity, 1977). Hence, there is support for the view that *at least some* of the phenomena labeled auditory hallucinations are actually related to sounds or kinesthetic stimulation (associated to the vocal musculature) produced by the perceiver, although many hallucinators do not know they are generating such stimuli. Such a conclusion is consistent with the results of several of the earlier discussed hallucination-reduction studies (e.g., Erickson and Gustafson, 1968; Lindsley, 1963).

Are these observations consistent with the reported decrease in hallucinatory behavior when either aversive consequences (e.g., Bucher and Fabricatore, 1970; Haynes and Geddy, 1973; etc.) or positive consequences (Lindsley, 1963) are contingent on such behavior? Aversive procedures do work some of the time, but this does not necessarily suggest that hallucinations are due entirely or even in large part to consequences for such behavior in the same way that headaches are not caused by lack of aspirin, however effective aspirin may be at relieving such distress.

Perhaps Lindsley’s paradoxical results—that candy contingent on psychotic verbalizations decreased such verbalizations—can be explained by the notion that the target behavior was too molecular and rapid to be increased. Other interpretations may hinge on the limited duration of his study, the possibility that candy for these subjects under these conditions was not a reinforcer, and the possibility that the eating of candy interfered with subvocalizations in a fashion similar to Erickson’s and Gustafson’s

(1968) techniques of humming and gargling. One important point, however, is that auditory hallucinations and psychotic behavior in general have not been shown to be completely sensitive to reinforcement procedures. Viewing such behavior as parasitic on appropriate verbal behavior may be one way to account for the occurrence of such phenomena without having to locate consequences that specifically maintain such behavior.

SKINNER'S THEORY OF VERBAL BEHAVIOR APPLIED TO HALLUCINATIONS

The following section will review aspects of Skinner's theory of verbal behavior that may account for the origin and maintenance of auditory hallucinations. It will be suggested that there is, at least in some instances of hallucinatory behavior, a progression which starts with the hearing of non-verbal auditory stimuli as "voices."

It is hypothesized that when the "mishearing" of various ambiguous stimuli and the production of subvocal behavior occurs, various explanatory systems are provided by the subject to account for the presence of apparently independent voices. Also it will be suggested that this interpretation of internally and externally generated cues may then generalize across behavioral classes, so that a person's overt verbal behavior comes to resemble his or her covert language with its complex and even random determinants.

Based on Skinner's theory, two primary mechanisms are hypothesized in the onset and maintenance of the smaller or larger strings of responses that are labeled auditory hallucinations. The first mechanism is that of responding to ambiguous stimuli produced by the environment or by "physiological activities in the listener" (Skinner, 1957, p. 264); the second is that of generating strings of words (much like automatic writing, speaking in tongues, etc.) that are mainly self-

intraverbally¹ or echoically² determined. It is also suggested that subvocalizations may cue these frequent (short or extended) chains of unedited verbal "psychotic" behavior.

Responding to Ambiguous Stimuli

A model of the origin of auditory hallucinations may be seen in studies involving the verbal summator used by Skinner (1957). The verbal summator

consists of a phonograph or tape recorder which repeats a vague pattern of speech sounds at low intensity or against a noisy background as often as may be needed to evoke a response. The material sounds like fragments of natural speech . . . the device evokes behavior more readily if the true nature of the patterns is concealed from the speaker. Under satisfactory experimental conditions, a subject will generally hear something being said for each pattern, and most subjects require no more than ten or fifteen presentations of each stimulus . . . These (responses) bear very little formal relation to the stimuli (different subjects seldom give the same response) . . . (and) tend to be unedited . . . because the subject remains unaware of the controlling sources and is usually convinced that he is merely repeating what he hears, although possibly with inaccuracy (p. 260).

Skinner noted that situational variables also determined to some extent the verbal responses emitted and that various motivational variables seem to play some role in the exact form of the verbal behavior evoked by the verbal summator.

Stimuli functionally similar to those

¹ An example of intraverbal behavior is saying the word "three" immediately after someone says: "One—two—." Skinner (1957) suggests that, in addition, grammar and syntax are in part autoclitically determined. The interested reader is referred to Chapters 4, 12, and 13 in *Verbal behavior* as well as to Winokur's (1976) *Primer of Verbal behavior: An operant approach*.

² Skinner (1957) gives this example of echoic behavior: "Upon hearing the sound *Beaver*, the speaker says *Beaver*" (p. 55) and he goes on to note: "a fragmentary echoic behavior appears in what are called 'clang associations'—responses which are alliterative or rhyming or otherwise similar to the stimulus word. A fragmentary self-echoic behavior . . . may be shown in reduplicative forms like *helter-skelter*, *razzle-dazzle*, and *willy-nilly*" (p. 56). Winokur (1976, pp. 91–92) says that "The principal activity of the hearer as a *listener* (what he is doing as the speaker speaks . . .) is to engage in *covert echoics* (small amplitude)."

produced by the verbal summator may be commonly encountered by those experiencing auditory hallucinations. As Skinner (1957) said: "In hearing voices we cannot assume that there is no echoic stimulus, since noises generated by physiological processes in the listener himself may suffice; and in many cases such hallucinations seem to be encouraged by external stimuli, such as the rustling of leaves" (p. 264).

Furthermore, Skinner has suggested that hearing nonverbal stimuli as voices may involve "internal echoic and intraverbal strengthening" (pp. 263–264). (Internal echoic stimuli include those internal supplementary stimuli we provide in listening to another talk, and are subvocal in nature.) As Skinner, 1980, observed: "'Attending' . . . (to a person speaking) seems to mean speaking along with the voice. This is the active side of understanding" (p. 352, quotation marks Skinner's.) (It is interesting to note that the work of Gould (1950), Erickson and Gustafson (1968), and McGuigan (1966) support the view that physiological stimuli such as inhaling and exhaling may cue the internal echoic verbal behavior.³

In an early article (1936), Skinner described some of his research with the verbal summator and concluded that:

The behavior of a subject in 'reading into the sounds some meaning of his own' is part of the experience of most people. The paranoid who overhears criticisms of himself and the mystic who hears voices from the other world are only extreme cases of this familiar phenomenon (p. 104).

Furthermore, while the verbal summator emits "material (that) sounds like fragments of natural speech" (Skinner 1957, p. 260), it may be possible to use continuous rather than fragmentary stimuli and

to shape hearing those stimuli as ongoing voices in different situations, thereby bringing about behavior which may be labeled psychotic. Skinner (1953) suggests that such a strategy is possible for teaching someone to see patterns of dogs in various visual displays (conditioned seeing). Such factors, however, probably do not entirely account for hallucinatory behavior.

Hence, it is proposed that at least some reports of the hearing of voices are similar to the phenomenon observed in studies using the verbal summator—that is, the listener interprets various ambiguous stimuli as voices. Later, the listener may interpret more and more stimuli in other situations as voices.

Emitting Strings of Words

Mishearing auditory stimuli as specific verbal behavior may be a common phenomenon. Skinner (1957, pp. 259–260) gives examples of how such phenomena have been used as literary devices by various writers. Skinner (1957, pp. 212–214) also proposes several other variables that may affect the strength of such verbal behavior. These include: deprivation, aversive conditions, drugs, and age. Again, such variables probably do not account entirely for the auditory hallucinations especially prevalent among those labeled "psychotic." While much of the origin of auditory hallucinations may be attributed to the above mechanism (mishearing stimuli), unedited verbal behavior (often cued by physiological stimuli and preceding subvocalizations) is frequently important to the elaboration and generalization of auditory hallucination phenomena.

An appropriate analog for the study of such unedited verbal behavior is automatic writing. (Although intraverbal strengthening may be seen in Skinner's results with the verbal summator, how long chains of verbal behavior are strung together is more apparent in the behavior of automatic writing.) In his article, "Has Gertrude Stein a Secret?", Skinner (1934) described automatic writing as a kind of verbal behavior largely under intraverbal

³ Normal people may find themselves more easily distracted (and perhaps may be more easily conditioned) at the onset of inhaling or exhaling. So too, hallucinators are more likely to hear such physiological stimuli as voices. Relatedly, these occasions (especially when breathing during exertion or when the body is positioned in such a way as to magnify physiological responses) may be especially noisy and prompt similar, high amplitude guttural subvocalizations.

control. While the portions of Stein's writings examined by Skinner are largely intelligible,

Grammar is ever present—that is the main thing. We are presented with sentences . . . but we often recognize them as such only because they show an accepted order of article, substantive, verb, split infinitive, article, substantive, connective, and so on. The framework of the sentence is there, but the words tacked upon it are an odd company (1934, p. 53).

In automatic writing, what is written may not "make sense" to the writer or to the reader. Similarly, words don't have to "make sense" to a listener in order for the listener to "hear" (internally echo) them. The thesis presented does not imply that auditory hallucinations are always grammatically correct, but rather that grammatical frameworks make ambiguous auditory stimuli more likely to evoke echoic responses of the listener heard as voices.

While automatic writing can be increased, elaborated, and so on, through the use of reinforcing contingencies (engaging in it may be reinforced by others—for example, by Stein's coterie and publishers), one of its salient features is its dependence on antecedent events. Some forms of auditory hallucinations may be internal echoic responses to stimuli generated by various physiological (including respiration) and environmental events; the longer chains of utterances are "heard" in grammatical frames. Since these evoked echoic responses (necessary for the everyday maintenance of conversations) are not self-edited, they may appear foreign to the speaker.

So, one of the features of automatic writing is that the writer is "not aware" of what is being written. Among other things, this writing behavior is not self-edited and is "unintended" (if asked, the subject would not be able to predict what would be "written" next). As several of the earlier cited studies have indicated, this sort of independence between "self" and verbal product also commonly distinguishes the perceiver from the auditory hallucinatory voices heard (e.g., Gould, 1950). Skinner (1957) said, "When feed-back from verbal behavior

has been lacking at the time of emission and when the speaker or writer is then faced with evidence of that behavior, he is likely to attribute it to another person . . . When evidence of personal participation is inescapable, there is a tendency to assign the work to supernatural forces" (p. 390–391). This "tendency" may be the same tendency to attribute the cause of the voices to God, the radio, etc., and the outcome of such an attribution may be the production of a delusional system.

Should the process result in long chains of nonsense verbalizations, normal (edited) verbal behavior may become contaminated by the unedited verbal responses. Thus the normal behavior may come to resemble more and more the nonsense covert responses. Over time, such unedited verbal behavior may occur at a high rate, and unless there is an enhanced tendency toward self-editing, the hallucinatory behavior may be evoked by an increasingly wide range of stimuli.⁴ On the other hand, it would be predicted that single- or several-word utterances would not lead to the same degree of verbal contamination because they would not be bridged by grammatical frames.

The relative independence of various forms of verbal behavior would seem to be necessary to maintaining a conversation (e.g., listening to what a speaker is saying and thinking of a response). Presumably, through practice people grow to be so skilled in such behavior that it is emitted without their "knowing" it. Further, with verbally sophisticated people, it may well be that occasional bursts of subvocal stimuli (perhaps more common under "emotional" conditions) are enough to set off other chains of echoic

⁴ Other phenomena perhaps similar to automatic writing in terms of greater self-intraverbal and self-echoic determination and less self-editing than regular discourse include: speaking in strange tongues (glossolalia), the use of Ouija Boards, improvisational jazz playing, "double-talk," and the form of speech used by auctioneers. While there is some self-intraverbal and self-echoic determination in these activities, both textual determinants, such as staying in a 4/4 time, as well as self-editing, etc., occur to some extent.

behavior which are also influenced by intraverbals. The subject may then ask questions of the voices and hear the subsequent stimuli as a response, or answer the voices' questions, thereby carrying on a lengthy dialogue. Eventually the voices may be heard to provide a running commentary on the individual's behavior or thoughts, or, more elaborately, two or more voices may converse with each other, thereby earning the patient a label of schizophrenia (DSM-III, p. 188).

In explaining how such verbal responses may account for some of the major deficits of psychotic behavior we agree with the view of Malott, Tillema, and Glenn (1978) that "We don't want to over-stress the role private verbal behavior plays in controlling our acts, because much of the time, outside, or public, cues control what we do. For instance, if the phone rings, we don't tell ourselves to pick it up—we just pick it up" (p. 132). While an examination of the thinking of non-psychotics may not be necessary to account for much of what they do in everyday situations, such private behavior, however, usually does not interfere with many other activities. With psychotics, on the other hand, covert and overt verbal behavior may well compete with or reduce the strength of normal verbal behavior. In addition, normally people often emit responses which have the effect of bringing other behavior more in line with operating contingencies (e.g., double-take and certain forms of observational behavior). It is proposed that such behavior in psychotics has undergone extinction. If one is continually interrupted with background voices (or noises), maintaining and regaining the thread of conversation may extinguish as a response class.

Thus a person with such an ongoing string of nonsense echoic responses may live much of the time in an idiosyncratic world, talking continually to the residents therein. Furthermore, the perceiver's talking to the voices is maintained in part because of the reinforcement he or she has received and will continue to receive from other people in the real world. In a real way, then, such auditory

behavior may be parasitic on everyday verbal behavior.

Hence, the proposal is offered that at the outset, some of those with auditory hallucinations hear various ambiguous auditory stimuli, such as rustling leaves, verbal summator-like sounds, and physiologically self-generated stimuli as voices, producing internal echoic responses in which voices correspond to external verbal stimuli. These internal echoic responses (subvocalizations) sometimes evoke (through intraverbal grammatical-frame strengthening) subsequent responses, and for some the result is that strings of words are generated, strung together without self-editing in a haphazard, non-sequitor fashion. Unlike more appropriate verbal behavior, such strings are relatively unrelated to "meaning" (i.e., relevant antecedent and consequent controlling variables) and other referents in the perceiver's environment. This form of verbal behavior may be more frequent in times of emotion, deprivation, etc. For those who commonly hear single or several word utterances only, intraverbal influences may not be as potent.

Several characteristics of the long strings of unedited verbal behavior may then contribute to the further breakdown of appropriate discriminative control. Such characteristics include its often covert and private aspect (hence, no control by the verbal community), its low response cost (hence, its high rate), and the occasional instances when such speech is reinforced by its social or automatic consequences (hence, its resistance to extinction).

With the mislabeling of external and internal stimuli as voices, it is reasonable that delusional systems are produced to explain the cause of such behavior. It also follows that the explanations are in keeping with the times. Hence, in former days the voices may have been attributed to spirits or to God(s). At present, attributing the sources of the voices to television sets and radios is common.

It is proposed that these explanations will result in more and more control by inappropriate stimuli, especially as such

explanations probably reduce tendencies toward self-editing. At first, the hearing of voices may occur only at times when verbal behavior is relatively weak, such as during periods of drowsiness, drug intake, or during periods of heavy emotion (with many competing stimuli and no verbal behavior having a particularly high probability of occurring). In time, the above combination of factors and the particular learning history join to increase the probability of such behavior in a wider number of situations.

Why the proposed condition exists in some individuals and not in others is, of course, unknown. It may be noted, however, that the physiological requirements of fluent verbal behavior are certainly very great. Perhaps small anomalies in these physiological substrates are responsible for such effects and this may explain why some psychotic conditions may be limited to organisms capable of vocal speech.

FUTURE STUDIES

Because of space limitations, the following must constitute only a small sample of topics for future studies. It is suggested that normative data be gathered on the frequency and nature of mislabeling of stimuli as voices. What percentage of people report auditory hallucinations? Under what circumstances do they occur? One outcome of such research may be to demonstrate that auditory hallucinations are not unusual. Such information would likely prove to be reassuring to a sufferer and may prevent undue emotional behavior precipitating additional hallucinations. For example, should people assume that hearing voices is a "sign of insanity," their emotional reaction (including laryngeal tension and an increased likelihood of remembering instances of hearing voices) may make the assumption a self-fulfilling prophecy. Also as Skinner (1957, p. 260) found with the verbal summator, the voices may be evoked less readily if sufferers know what the true source of the voices is.

The relation between mislabeling and

emotional behavior—especially, perhaps, in the learning of a new language (when the perceiver must act on the signal he receives even when in doubt as to its authenticity) and in older age (when hearing becomes less acute)—should be investigated (see Skinner, 1957, p. 214). At such times, too, in addition to the tendency on the part of the listener to "fill in the blanks," there is probably much laryngeal activity (Note 1).

The inclusion of cross-cultural variables in developing norms also seems desirable. Members of certain cultures who report hearing voices may not be considered abnormal by other members of those cultures, and they may not be as likely to label themselves insane should they have auditory hallucinations. In addition, they probably would not develop some of the more bizarre delusional systems because the self-offered explanations do not separate one from the community of beliefs.

A study replicating Lindsley's (1963) results in the manipulation of verbal behavior presumably related to auditory hallucinations would also be useful. It is proposed that for some hallucinators, auditory stimuli most resembling their own subvocal behavior would increase auditory hallucinations. Related would be studies examining the use of hearing aids among psychotic patients, as this population may be particularly sensitive to the ambiguous stimuli magnified by such devices.

It is suggested that the competing behavior approach (e.g., humming and gargling at the onset of the voices) as well as one reducing the amount of physiological noise be examined as a treatment for hallucinators (especially first time, highly motivated hallucinators).⁵ These

⁵ Skinner (1957, p. 434) noted that if a person should open wide his mouth and think the words "bubble, bubble" with some practice he would be more aware of his subvocalization of the words. On the other hand, the same effect (magnification of subvocal responses) seems to be achieved by dropping one's head down towards one's chest, a posture less likely to be punished by others than having one's mouth wide open.

hallucinators may be generating in whole or in part the stimuli they interpret as voices, and, more important, their hallucinatory and delusional behavior may be relatively easily modified if caught early in the process. Hence, the eventual production of long chains of unedited verbalizations may be prevented. Should this approach prove useful, certainly future researchers would need to investigate the parameters of these methods.

Some investigation may also reveal that auditory hallucinations are related to the onset of exhaling and inhaling. (Gould, 1950, and Erickson and Gustafson, 1968, implicate breathing as one determinant.) Perhaps a simple observation of breathing together with auditory monitoring and a signalling of the onset of voices would reveal such an association. Relatedly, a local anesthetic administered to the laryngeal area, it is predicted, would also lead to a reduction in the rate of the voices.

Furthermore, it is also suggested that physiological noise is greater in post-adolescence (because of muscle development) and that such noise increases the likelihood of subsequent auditory hallucinations. At the same time, the rate of extended internal speech appears to be much greater. When internal speech becomes very frequent, the sophisticated listener, responding to very subtle cues, may mishear much nonverbal stimuli as verbal stimuli. Studies of such internal speech may well reveal the relatively late onset of self-directed thematic probes and extended inner dialogues and, in addition, the correlation between the time of hearing the voices and time of puberty.

In addition, it is suggested that the examination of auditory hallucinations and visual hallucinations in those without hearing from birth would reveal the contribution of the "hearing of voices" to psychotic behavior. (It is suggested that intraverbal strengthening may play a role in the elaboration of visual hallucinations as well.) Do the deaf dactyly echo the responses of others signing to them? Does the amplitude of such echoing responses decrease as the listener grows more skilled at signing? The proposed de-

crease in amplitude of echoic signing may allow, in a sense, the "listener" to use aspects of the same language system (i.e., hand-signing) for other things—such as thinking about what the signer is saying.

SUMMARY

This essay represents an attempt to account for auditory hallucinations with several aspects of Skinner's theory of verbal behavior. Some of the major studies of auditory hallucinations outside the field of behavior analysis have been examined and have shown results compatible with Skinner's theory. Further, Skinner's theory as presented in this paper seems to account for common aspects of auditory hallucinations, such as single or several word utterances versus ongoing chains of nonsense verbalizations, the contamination of normal verbal behavior by long chains of unedited verbal behavior, the hearing of voices in noisy environments, the attribution of the voices to various agents, and the involvement of self-produced physiological stimuli in this disorder.

While Skinner's analysis is often not an easy one to grasp, it does seem to have much potential for the interpretation, prediction, and control of hallucinatory phenomena. Future studies may reveal that the key to understanding much of this interesting behavior is to be found in the pages of Skinner.

REFERENCE NOTES

1. Personal communication, Eugene Lee, University of Hawaii.

REFERENCES

- Alford, G., & Turner, S. Stimulus interference and conditioned inhibition of auditory hallucinations. *Journal of Behavior Therapy and Experimental Psychiatry*, 1976, 7, 155-160.
- American Psychiatric Association. *Diagnostic and statistical manual of mental disorders (DSM-III)*. Third edition, Washington, D.C., APA, 1980.
- Bucher, B., & Fabricatore, J. Use of patient-administered shock to suppress hallucinations. *Behavior Therapy*, 1970, 1, 382-385.
- Erickson, G., & Gustafson, G. Controlling auditory hallucinations. *Hospital and Community Psychiatry*, 1968, 19, 327-329.
- Falloon, I., & Talbot, R. Persistent auditory hal-

- lucinations: Coping mechanisms and implications for management. *Psychological Medicine*, 1981, 11, 329-339.
- Fisher, E., & Winkler, R. Self-control over intrusive experiences. *Journal of Consulting and Clinical Psychology*, 1975, 43, 911-916.
- Garritty, L. Electromyography: A review of the current status of subvocal speech research. *Memory & Cognition*, 1977, 5, 615-622.
- Gomes-Schwartz, B. The modification of schizophrenic behavior. *Behavior Modification*, 1979, 3, 439-468.
- Gould, L. Verbal hallucinations as automatic speech: The reactivation of dormant speech habit. *American Journal of Psychiatry*, 1950, 107, 110-119.
- Haynes, S., & Geddy, P. Suppression of psychotic hallucinations through time-out. *Behavior Therapy*, 1973, 4, 123-127.
- Heppner, P. The clinical alteration of covert thoughts: A critical review. *Behavior Therapy*, 1978, 9, 717-734.
- Inouye, T., & Shimizu, A. The electromyographic study of verbal hallucination. *Journal of Nervous and Mental Disease*, 1970, 151, 415-422.
- Lindsley, O. Direct measurement and functional definition of vocal hallucinatory symptoms. *Journal of Nervous and Mental Disease*, 1963, 136, 293-297.
- Malott, R., Tillema, M., & Glenn, S. *Behavior analysis and behavior modification: An introduction*. Kalamazoo, Mich.: Behaviordelia, 1978.
- McGuigan, F. Covert oral behavior and auditory hallucinations. *Psychophysiology*, 1966, 3, 73-80.
- Moser, A. Covert punishment of hallucinatory behavior in a psychotic male. *Journal of Behavior Therapy and Experimental Psychiatry*, 1974, 5, 297-299.
- Nydegger, R. The elimination of hallucinatory and delusional behavior by verbal conditioning and assertive training: A case study. *Journal of Behavior Therapy and Experimental Psychiatry*, 1972, 3, 225-227.
- Paul, G. Chronic mental patient: Current status—future directions. *Psychological Bulletin*, 1969, 71, 81-94.
- Skinner, B. F. Has Gertrude Stein a secret? *Atlantic*, 1934, 153, 50-57.
- Skinner, B. F. The verbal summator and a method for the study of latent speech. *Journal of Psychology*, 1936, 2, 71-107.
- Skinner, B. F. *Science and human behavior*. New York: Macmillan, 1953.
- Skinner, B. F. *Verbal behavior*. Englewood Cliffs, NJ: Prentice-Hall, 1957.
- Skinner, B. F. *Notebooks*. Englewood Cliffs, N.J.: Prentice-Hall, 1980.
- Slade, P. The effects of systematic desensitization on auditory hallucinations. *Behaviour Research and Therapy*, 1972, 10, 85-91.
- Turner, S., Hersen, M., & Bellack, A. Effects of social disruption, stimulus interference, and aversive conditioning on auditory hallucinations. *Behavior Modification*, 1977, 1, 249-258.
- Weingaertner, A. Self-administered aversive stimulation with hallucinating hospitalized schizophrenics. *Journal of Consulting and Clinical Psychology*, 1971, 36, 422-429.
- Winokur, Stephen. *A primer of verbal behavior: An operant view*. Englewood Cliffs, N.J.: Prentice-Hall, 1976.